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STATE OF WASHINGTON
Dixy Lee Ray
Governor

DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, Olympia, Washington 98504 206/753-2353

M E M O R A N D U M

October 19, 1978

To: John Glynn

From: Shirley Prescott

Subject: Swinomish Channel Bacteriological Survey

Introduction

Swinomish Channel is located in the southwest portion of the San Juan Archipelago between Fidalgo Island and the mainland (Figure 1). It measures about five miles long by less than one-fourth mile wide consisting of tidal waters and, to a lesser degree, freshwaters from the Skagit River. LaConner, the only community situated along the slough, is a small port that uses the watercourse for a variety of water-related activities (fishing craft, pleasure boats, towing) as well as receiving waters for wastes.

On 16 August 1978 a receiving water survey was conducted on the channel. The main purpose was to determine if bacterial densities have changed during the three-year period since 1975 when a similar survey was conducted. Data on general water quality also were collected.

Methods

Surface water samples were collected during low tide at 11 stations (Figure 1). The timing coincided with the previous study (Appendix). Because of changes that have taken place in LaConner during the last three years, four stations (2, 4, 5 and 11) were dropped from the old survey and four added to the present effort. The new stations included:

4A Swinomish Channel outside Shelter Bay,

7A Channel at Port of Skagit County Marina,

12 Channel at Something Fishy Fish Company,

13 Channel at LaConner STP outfall.

Fifteen water quality characteristics were measured at each station. Temperature and D.O. (Winkler Method) were determined in the field. In

addition, samples were collected and iced, then transported to the DOE analytical laboratory the same day for the following analyses:

pH
Turbidity (NTU)
Fecal Coliform (Col./100 ml)
Specific Conductivity (μmhos/cm)
Nitrate-N (mg/l)
Nitrite-N (mg/l)
Ammonia-N (mg/l)
Orthophosphates-P (mg/l)
Total Phosphates-P (mg/l)
Total Suspended Solids (mg/l)
Total Suspended Non-Volatile Solids (mg/l)
Total Oils (mg/l)

Salinities were calculated by correlation of temperature and specific conductance. Not all analyses were conducted on all of the samples.

All samples were collected at mid channel with the exception of the new samples which were taken near point sources suspected of polluting the waters.

Results

Fecal coliform levels may have been a little higher at the south end of the channel and lower at the north end than the previous study, although a clear trend was not evident (Table 1). The counts appeared to be generally lower than 1975 in the middle section of the channel near LaConner, with the exception of Moore Clark (station 6) where >5,000 fecal coliforms were detected (Figure 1 and Table 1).

Nutrient levels in the channel appeared to be substantially lower in 1978 than during the 1975 survey (Table 1). Nitrate-nitrogen, an important indicator of nutrient enrichment, was about one-third as high during 1978 as the earlier survey. Ammonia-nitrogen was about one-sixth as high as the previous effort. Nitrite-nitrogen and phosphates ($O\text{-}PO_4\text{-}P$ and $T\text{-}PO_4\text{-}P$) were about the same during both surveys.

Temperature, dissolved oxygen, pH, conductivity, total suspended solids, total non-volatile suspended solids, and salinity were determined in 1978 but not 1975. All were within expected ranges for a watercourse like Swinomish Channel. The conductivity values were somewhat lower than marine waters in general for northern Puget Sound, apparently due to the influence of the Skagit River. Solids were present in moderate amounts and appeared to be mainly inorganic, as indicated by the large percentage of TNVSS (Table 1).

Discussion and Recommendations

At the time of this survey, water quality in Swinomish Channel generally was quite good. With the exception of fecal coliforms, which showed a median value of 56 col/ 100 mls, all other parameters were within the limits of Class A waters.

The DOE Waste Discharge Inventory shows all known dischargers at LaConner to be sewered to the LaConner STP or operating under NPDES permits providing for proper waste abatement practices. The high fecal coliform count at station 6 indicates a point source near this site. Point sources near this site should be inspected.

Examination of 1974 DOE routine monitoring data for station 03A050, North Fork Skagit River at Conway, R.M. 4.4, show fecal coliform levels exceeding Class A Standards with a median value of 220 col/100 mls during July through September (Table 2). While bacterial dieoff in the marine waters should effectively minimize these bacterial levels there could still be some impact on the channel.

SP:ee

cc: Dick Cunningham
John Bernhardt
Central Files

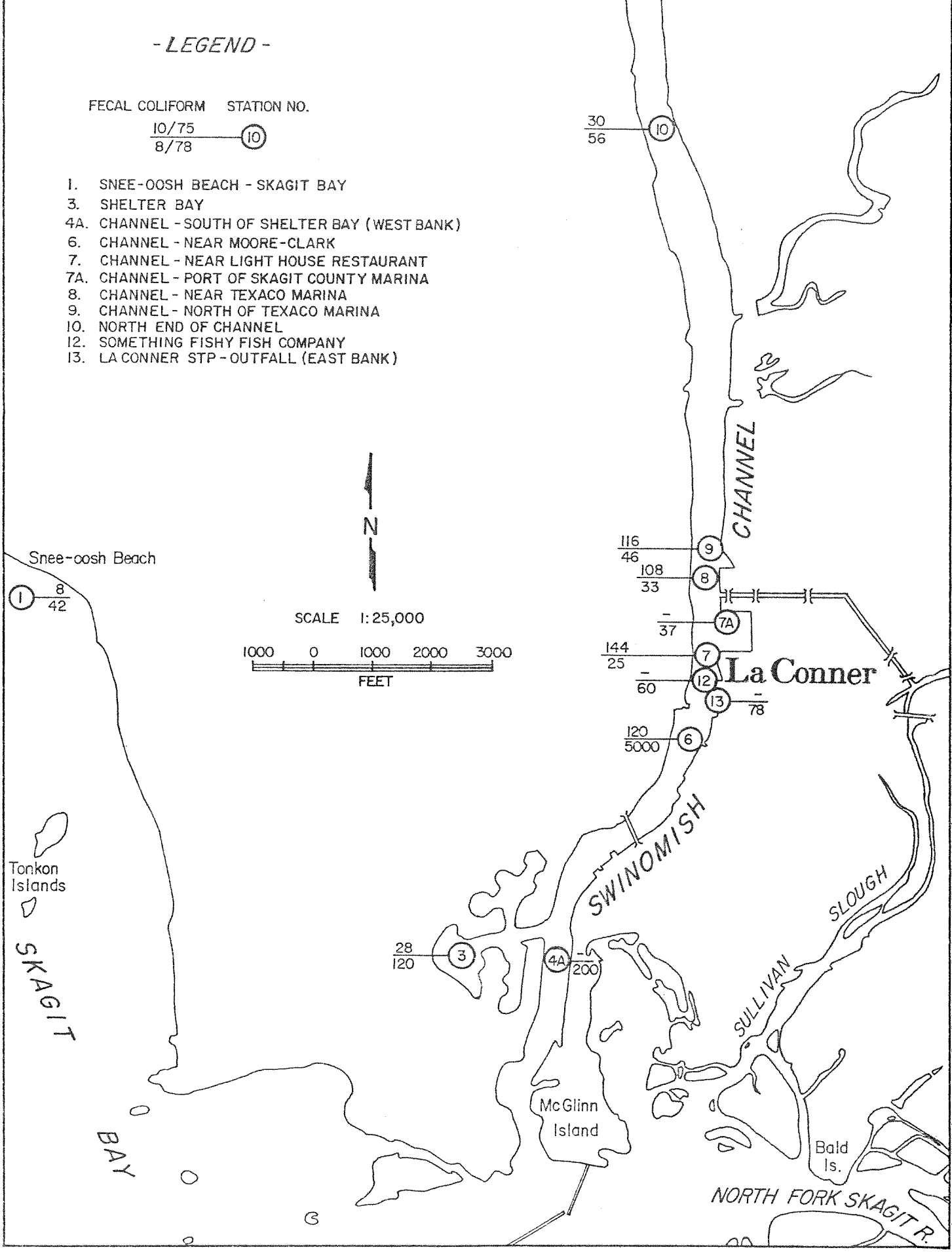


Figure 1. MAP SHOWING WATER QUALITY MONITORING STATIONS - SWINOMISH CHANNEL AND VICINITY, SURVEY 8/16/78.

Table 1. Summary of Water Quality Sampling Data Collected by DOE from Swinomish Channel during 15 October 1975 and 16 August 1978

Station	Description	Turbidity (NTU) 1975/1978	Temp (°C) 1978	D.O. (mg/l) 1978	pH 1978	Conductivity (μmhos/cm) 1978	Salinity (o/oo) 1978	F. Coliform (col/100 ml) 1975 / 1978
1	Snee-oosh Beach	6 / 7	13	6.9	7.8	31.3	25.8	8 / 42
2	South Entrance of Swinomish Channel	4 / -	- -	- -	- -	- -	- -	92 / -
3	Shelter Bay	4 / 6	13.6	7.6	7.8	30.5	24.8	28 / 120
4A	Swinomish Channel outside Shelter Bay	- / 7	13.6	7.6	7.8	30.3	24.4	- / 200
4	Channel off New England Fish	5 / -	- -	- -	- -	- -	- -	112 / -
5	Channel at LaConner Bridge	5 / -	- -	- -	- -	- -	- -	70 / -
6	Channel at Moore-Clark Fish	5 / 7	13.6	7.4	7.6	31.0	25.1	120 />5,000
12	Channel at Something Fishy Fish Co.	- / 6	13.6	7.5	7.7	31.3	25.6	- / 60
13	Channel at LaConner STP Outfall	- / -	- -	- -	- -	- -	- -	- / 78
7	Channel at Lighthouse Restaurant	6 / 5	13.6	7.4	7.8	31.5	25.9	114 / 25
7A	Channel at Port of Skagit County	- / -	- -	- -	- -	- -	- -	- / 37
8	Channel at Texaco Marina	5 / 6	13.6	7.5	7.7	30.2	24.6	108 / 33
9	Channel N. of Texaco Marina	5 / 5	13.6	7.6	7.7	31.3	25.6	116 / 46
10	North Entrance of Channel	5 / 5	13.2	7.6	7.8	31.5	26.0	30 / 56
11	Padilla Bay	5 / -	- -	- -	- -	- -	- -	10 / -

Table 1. Summary of Water Quality Sampling Data Collected by DOE from Swinomish Channel during 15 October 1975 and 16 August 1978 (Continued)

Station	Description	Nitrates-N (mg/l) 1975/1978	Nitrites-N (mg/l) 1975/1978	Ammonia-N (mg/l) 1975/1978	Ortho-Phosphates-P (mg/l) 1975/1978	Total Phosphates-P (mg/l) 1975 / 1978	TSS (mg/l) 1978	TSNVS (mg/l) 1978	Tota Oils 1978
1	Snee-oosh Beach	.30 /.09	< .01/<.01	.03 /.01	.06 /.03	.14 /.08	6	5	- -
2	South Entrance of Swinomish Channel	.10 / -	< .01/ -	.03 / -	.02 / -	.04 / -	- -	- -	- -
3	Shelter Bay	.22 /.08	< .01/<.01	.04 /.01	.05 /.06	.06 /.06	15	14	- -
4A	Swinomish Channel outside Shelter Bay	- /.09	- /<.01	- /.01	- /.06	- /.08	13	12	- -
4	Channel off New England Fish	.23 / -	< .01/ -	.05 / -	.05 / -	.08 / -	- -	- -	- -
5	Channel at LaConner Bridge	.23 / -	< .01/ -	.05 / -	.05 / -	.07 / -	- -	- -	- -
6	Channel at Moore-Clark Fish	.23 /.09	< .01/ <.01	.06 /.01	.05 /.06	.08 /.05	19	18	- -
12	Channel at Something Fishy Fish Co.	- /.10	- /<.01	- / .02	- /.06	- /.10	19	17	1
13	Channel at LaConner STP Outfall	- / -	- / -	- / -	- / -	- / -	- -	- -	- -
7	Channel at Lighthouse Restaurant	.24 /.09	< .01/ <.01	.06 /< .01	.06 /.05	.09/.09	13	12	- -
7A	Channel at Port of Skagit County	- / -	- / -	- / -	- / -	- / -	- -	- -	- -
8	Channel at Texaco Marina	.23 /.09	< .01/ <.01	.06 /< .01	.05 /.05	.08/.08	10	9	- -
9	Channel N. of Texaco Marina	.23 /.08	< .01/ <.01	.06 /.02	.05 /.06	.08/.08	16	15	- -
10	North Entrance of Channel	.29 /.09	< .01/<.01	.06 /.01	.07 /.07	.09/.08	14	13	- -
11	Padilla Bay	.29 / -	< .01/ -	.06 / -	.07 / -	.10/ -	- -	- -	- -

Table 2. Summary of Routine Monitoring Data, WY 1974

STORET RETRIEVAL DATE 74/11/14
03A050 5703A050 12200675
48 20 31.0 122 21 03.0
SF SKAGIT RIVER AT CONWAY
53 WASHINGTON
PACIFIC NORTHWEST
PUGET SOUND (LOWER SKAGIT-03)
21540000 2111204
2 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	31504 TOT COLI MFIM LES /100ML	31616 FEC COLI MFM-FCBR /100ML	31672 FECSTREP PC M-ENT /100ML	00400 PH SU	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00080 COLOR PT-CO UNITS
74/06/11	1205		12.2000	11.4000	4400.00	200.000	30.0000	7.40000	7.00000	47.0000	19.0000
74/06/25	1145		10.8000	11.2000	1500.00	210.000		7.20000	13.0000	43.0000	16.0000
74/04/01											
VARIABLE	NUMBER		6.00000	6.00000	6.00000	6.00000	5.00000	6.00000	6.00000	6.00000	6.00000
	MAXIMUM		12.2000	13.6000	13000.0	360.000	100.000	7.60000	13.0000	64.0000	20.0000
	MINIMUM		6.70000	11.2000	1000.00	50.0000	16.0000	7.10000	1.00000	43.0000	16.0000
	MEAN		9.16666	12.5833	5133.33	185.000	43.2000	7.35000	6.33333	54.3333	17.3333
	VARIANCE		4.32275	1.07788	.2010E+08	10830.0	1081.20	.0310547	15.0667	80.2703	3.06689
	STAND DEV		2.07912	1.03821	4483.60	104.067	32.8816	.176223	3.88158	8.95937	1.75125
	COEF VAR		.226814	.0825068	.873429	.562526	.761149	.0239760	.612882	.164896	.101034
74/07/00											
74/07/16	1235		10.2000	11.3000	2900.00	190.000		7.50000	7.00000	42.0000	13.0000
74/07/30	1140		13.0000	10.5000	5800.00	550.000		7.40000	11.0000	39.0000	
74/08/13	1220		12.6000	10.7000	5400.00	420.000	620.000	7.00000	5.00000	42.0000	
74/08/27	1220		15.3000	10.4000	4500.00	100.000	10.0000	7.50000	6.00000	45.0000	13.0000
74/09/10	1145		12.9000	10.7000	7400.00	220.000	110.000	7.50000	7.00000	45.0000	12.0000
74/09/24	1120		14.1000	10.2000	3300.00	220.000		7.40000	4.00000	49.0000	15.0000
74/07/01											
VARIABLE	NUMBER		6.00000	6.00000	6.00000	6.00000	3.00000	6.00000	6.00000	6.00000	4.00000
	MAXIMUM		15.3000	11.3000	7400.00	550.000	620.000	7.50000	11.0000	49.0000	15.0000
	MINIMUM		10.2000	10.2000	2900.00	100.000	10.0000	7.00000	4.00000	39.0000	12.0000
	MEAN		13.0167	10.6333	4883.33	283.333	246.667	7.38333	6.66667	43.6667	13.2500
	VARIANCE		2.90176	.142773	.2805E+07	28026.7	107033	.0376465	5.86670	11.8695	1.58333
	STAND DEV		1.70345	.377854	1675.02	167.412	327.160	.194027	2.42213	3.44522	1.25831
	COEF VAR		.130867	.0355348	.343007	.590865	1.32632	.0262791	.363319	.0788981	.0949664
74/10/00											
00/00/00											
STATION	NUMBER		24.0000	24.0000	24.0000	17.0000	14.0000	24.0000	24.0000	24.0000	22.0000
	MAXIMUM		15.3000	13.6000	13000.0	550.000	620.000	7.60000	120.000	68.0000	75.0000
	MINIMUM		4.20000	10.2000	200.000	50.0000	10.0000	7.00000	1.00000	34.0000	11.0000
	MEAN		8.96666	11.9583	3812.08	201.765	105.214	7.37083	11.6250	52.7083	20.1818
	VARIANCE		11.1380	1.03932	.1106E+08	17940.4	27581.9	.0177586	548.071	95.1739	170.442
	STAND DEV		3.33736	1.01947	3325.91	133.942	166.078	.133261	23.4109	9.75571	13.0553
	COEF VAR		.372197	.0852518	.872464	.663852	1.57847	.0180796	2.01384	.185089	.646897
99/99/99											

APPENDIX

MEMORANDUM

November 7, 1975

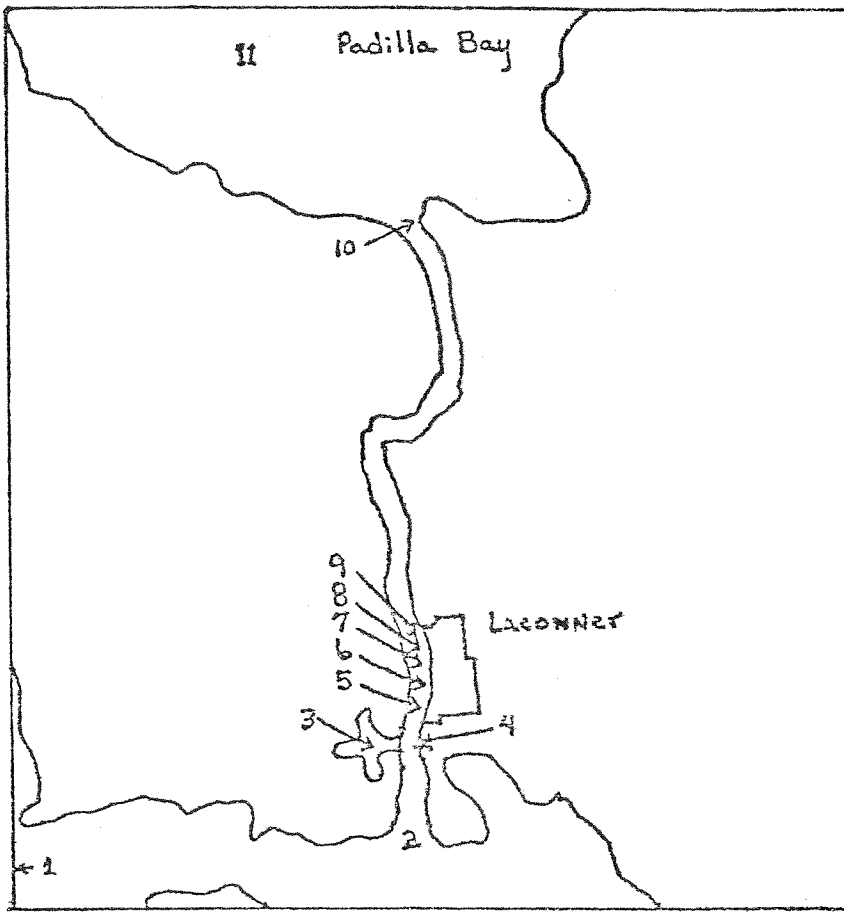
To: John Glynn

From: Phil Williams

Subject: Swinomish Channel Survey

Eleven samples were taken at various locations on the Swinomish Channel on October 15 at a low slack tide. Samples for bacterial analysis were sent to the Redmond laboratory and nutrient analyses were done at the Southwest Regional laboratory. The following is a list and diagram of the sample locations.

1. Skagit Bay
2. Southern entrance to channel
3. Center of Shelter Bay
4. Center of channel off New England Fish Co.
5. Under the bridge
6. Center of channel off Moore-Clark
7. Center of channel of Lighthouse Restaurant
8. Center of channel off sewer outfall by Texaco Marina
9. Center of channel 300 feet north #8
10. North end of channel
11. Padilla Bay



The results of all analyses are given in the attached lab sheet. Bacteriological counts show a definite increase in total and fecal coliform numbers in the channel over ambient levels in Skagit Bay and Padilla Bay. Background concentrations in these two areas were well within Class A marine

water standards. Of the nine samples taken in the channel all but the most northerly sample exceeded standards. Median values for these samples were 650 total and 108 fecal. Mean values were 592 and 88. Throughout the sampling run there were no visible signs of raw sewage coming from the city of LaConner's outfall pipes. This may be one reason for the values being much lower than the 36,000 and 160 (Est) values found in a sample taken July 9 of this year. One researcher has shown an 80% reduction in numbers of coliforms after 30 minutes contact with sea water. Therefore high bacterial counts can only be expected during and shortly after contamination.

Results of nutrient analyses were inconclusive.

PW:ee
Attachment

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

WATER QUALITY LABORATORY

ORIGINAL TO: P.W.

COPIES TO:

LAB FILES

DATA SUMMARY

Source Swinomish Channel Collected By P. Williams

Date Collected 10-15-75

Log Number:	75-4799	4800	01	02	03	04	05	06	07	08	09
Station:	1	2	3	4	5	6	7	8	9	10	11
pH											
Turbidity (JTU)	6	4	4	5	5	5	5	5	6	5	5
Conductivity (umhos/cm)@25°C											
COD											
BOD (5 day)											
Total Coliform (Col./100ml)	<50	750	250	1100	750	450	650	900	450	32	30
Fecal Coliform (Col./100ml)	8	92	28	112	70	120	114	108	116	30	10
NO3-N (Filtered)	0.30	0.10	0.22	0.23	0.23	0.23	0.24	0.23	0.23	0.27	0.29
NO2-N (Filtered)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NH3-N (Unfiltered)	0.03	0.03	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06
T. Kjeldahl-N (Unfiltered)	0.26	0.16	0.18	0.20	0.14	0.18	0.18	0.20	0.22	0.28	0.18
O-PO4-P (Filtered)	0.06	0.02	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.07	0.07
Total Phos.-P (Unfiltered)	0.14	0.04	0.06	0.08	0.07	0.08	0.09	0.08	0.08	0.09	0.10
Total Solids											
Total Non Vol. Solids											
Total Suspended Solids											
Total Sus. Non Vol. Solids											

Note: All results are in PPM unless otherwise specified. ND is "None Detected"
Convert those marked with a * to PPB (PPM X 10^3) prior to entry into STORET

* N.D = <.01

Summary By Stephen D. Reed Date 10-21-75